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ABSTRACT

A rationale for the inclusion of training in computer-assisted instruction (CAI) in teacher education programs at both preservice and inservice levels is presented. The nature of teacher training in computer-assisted language learning (CALL) is described through a variety of examples. Areas covered include: the need for an understanding of the potential applications of CALL in the learning process; the need for teacher training in CALL as reflected in the literature; training teachers in theory and technical knowledge; the kinds of CAI and CALL currently available; and questions raised by those using CALL and the proposed answers to those questions. An outline of useful topics to be covered in a teacher training course in CALL is presented. CALL courses for teachers should include familiarity with the history of microcomputers, with technology, and with educational concerns regarding the use of CALL. (CB)

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# Teacher Training for CALL and Its Implications

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## Introduction

The purposes of this chapter are to provide a rationale for the inclusion of training in computer-assisted instruction (CAI) in teacher education programs at both preservice and inservice levels and to suggest by example what the nature of teacher training in computer-assisted language learning (CALL) should be. Every era that witnesses a technological breakthrough or ideological advance lends itself to a descriptive label that attempts to capture its essence. In the middle of the 1980s one hears of the Communication Age, the Communication Revolution, the Technological Revolution, and the Information Explosion. Industry has the lead in the development of hardware and software. Education follows slowly on its

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heels. Library card catalogs are being replaced by computer files; word processors are replacing office typewriters. Secondary schools increasingly include "computer science" or "computer literacy" among requirements for graduation; some postsecondary schools place a microcomputer in the hands of every student. We are in the middle of a technological revolution. To ignore advances in technology is to be left behind. How to train teachers to make informed use of this technology is a major challenge for trainers and the focus of this writing.

This chapter is organized as follows: (1) the need for an understanding of the potential applications of CALL in the learning process; (2) the need for teacher training in CALL as reflected in the literature; (3) training teachers in theory and technical knowledge; (4) the kinds of CAI and CALL currently available; and (5) questions raised by CALL, proposed answers to those questions, and a suggested agenda for teacher training in CALL now and in the future.

## What Can Teachers Expect from CALL?

What can foreign language teachers find in the literature to help them select and integrate CALL into their curriculum? The literature on the topic, grounded in such diverse areas as psychology, educational psychology, linguistics, and psycholinguistics, is rich in implications, but the abundance of publications easily overwhelms preservice teacher trainees as well as classroom teachers. Moreover, there is little research based upon long-range studies in CALL that reflects the rapid changes in technology and available software. The picture is further complicated by conflicting evidence on the effect of CAI on achievement in different disciplines (often mathematics or sciences) with students of different age and class levels (frequently from elementary school or postsecondary programs). Furthermore, the nature of the hardware, the lesson design, and the degree to which CAI has been involved have varied dramatically. It is not surprising that foreign language teachers have difficulty finding CALL applications in the research.

### Methods and the Medium

In 1983 Clark (6)reviewed the research on and the use of media (including CAI) in educational settings and concluded that the evidence provided by media-based attempts to determine the components of effective instructional methods was questionable. Clark found that the investigation and formulation of theories of media attributes (what the intrinsic capabilities of media are believed to be) may be of use in instructional design, but they do not contribute to an understanding of the conditions effective methods

must meet in order for learning to take place. Clark suggested that future research focus on characteristics of methods used in instruction and related variables such as task, learner aptitude, and what the learner thinks he or she can get from the medium used in instruction. Clark found that high-ability students preferred more structured and directive methods and media, because they viewed them as a shortcut to success, but in fact such students were insufficiently challenged. On the other hand, low-ability students preferred less structured and more discovery-oriented methods and media, not wanting to expend the energy required in more directive methods, from which they anticipated poor results. Unstructured approaches for the latter students seemed to offer an escape in the crowd; in other words, students could remain passive, although they might otherwise have performed better with more structure. Clark concluded that where media are employed in teaching, the methods used in the media are probably decisive for student achievement, while learner expectations affect their preference for the type of media. In short, students think that specific kinds of media are related to specific learning outcomes, and teachers need to keep those student expectations in mind when integrating CAI into instructional programs. Indeed, the integration of a media component into a curriculum is a critical training consideration; most software now available is prepared with the assumption of either prior or concurrent study. Student aptitude, attitude, and learning strategies are thus important variables in the selection of software for different purposes as well as for the choice of media for presentation.

## Cognitive Development

A brief review of models of language learning and the role of aptitude is useful in informing teachers about where CAI might play a role in education. Since most commercially prepared CAI software is designed for beginning levels of instruction, it is important to consider language-learning theory applicable to age groups at the middle-school or secondary-school level, the target populations of most teacher-education programs in foreign language. However, some understanding of what seems to be happening at even earlier age levels prepares us to plan better. In 1981, Walsh and Diller (38) described research done on cognitive development from birth and concluded that young children are able to learn two languages simultaneously with a native accent in each because sound-mastery is a lower-level brain function at work long before higher-level functions develop. Later stages of cognitive development that occur after puberty are more pertinent to the integration within the learner of higher-order linguistic processes (semantic processing, word-object relationships, grammatical sensitivity, and grammatical reasoning), which in turn explains why postsecondary curricula are able to introduce greater

amounts of grammar and vocabulary in a given period than can be accomplished in elementary school programs. Heavy emphasis on grammar-demanding analytical skills is inappropriate at the elementary school level where emphasis on practical vocabulary and routine function is called for. The fact that the integration of sound into CALL programs—that is, voice recognition—is still primitive will preclude its discussion here, although sound or more precisely phonology plays an important role in language learning/acquisition. There are some promising possibilities on the horizon, such as interactive video and voice synthesizer/micro matches (see Marty and Hart, 21), that encompass various instructional aspects of interactive audio.

**Aptitude**

In extensive research, Carroll (3 and 4) has addressed the question of aptitude from the viewpoint of foreign languages. He does not downplay the importance of motivation and attitude as factors in the success of a learner, but states that foreign language aptitude "seems to consist of some special cognitive talent or group of talents that is independent of intelligence, and operates independently of the motivations and attitudes of the learner" (4, p. 94). Carroll breaks down these talents into four areas: phonetic coding, grammatical sensitivity, rote learning, and inductive reasoning. The instrument devised to evaluate these talents is the Carroll and Sapon *Modern Language Aptitude Test* or *MLAT* (1959), a widely used test for learners from grade 9 through adult. The *MLAT-Elementary* (Carroll and Sapon [1967]) is an adaptation of the MLAT designed for learners in the 3rd through the 6th grade. The *Pimsleur Language Aptitude Battery* or *PLAB* (Pimsleur, 1966) is particularly applicable to learners at the junior high school level. The PLAB contains six subtests to measure phonetic coding, verbal intelligence, and auditory ability and also provides for a measure of motivation, while the MLAT uses its five subtests to measure phonetic coding ability, grammatical sensitivity, and rote memory. Carroll states that weakness in any of these areas may be counterbalanced by instructional strategies or perhaps, in some cases, by time on task (Carroll's definition of aptitude). In short, learners with high aptitude may be expected to learn at a faster rate through CALL than those with low aptitude, although the latter may profit too from the motivational aspects that contact with the medium may afford.

Wesche (39) matched attitude and aptitude profiles with instructional modes among adult learners of French in the Public Service Commission of Canada. Aptitude test subscores, information gathered by trained staff through interview, and other means were used to place students appropriately. The core instructional method, Dialogue Canada, was inductive,

utilized audiovisual material, and was laddered in its sequencing of structural difficulties. Two alternative instructional modes were designed for students whose profiles suggested that the core program might be inappropriate, one Analytical, the other Functional. Both were built around the core program, but incorporated special patterns and activities to help capitalize upon the learning strengths of participants as well as to compensate for weaknesses.

The kinds of alternative instruction reported by Wesche, particularly those involving media, suggest hypotheses about the types of CALL programs to help learners who demonstrate particular deficiencies in aptitude or motivation and thus may be useful to a general range of students, as follows:

*Low Auditory Ability.* Programs with audio must have very clearly articulated voices speaking slowly. Presentation of the text on screen may be helpful. There should be provision for student control of pacing and repetition.

*Low Phonetic Sensitivity.* There is a similar need for control over pacing and repetition to practice sound/symbol correspondences. Programs that present graphics and simulations with text and offer a multisensory presentation help, too, as do tutorials and drills with attention to spelling to help fix written forms in memory.

*Low Grammatical Sensitivity.* Programs that point out patterns in syntax, grammatical functions, and analogies between first and second languages should incorporate explanations related to concrete examples and employ more functional than analytical language.

*Poor Memory.* Authoring programs with capabilities to allow the user to input needed vocabulary will help teachers modify drills for specific purposes. Students with poor memory benefit from contextualization, pictorials, and simulations. Programs that show and contrast simulated elements of the language that tend to be easily confused constitute another approach of possible benefit to the lower-aptitude learner with CALL.

It would be reassuring to know that the use of such CALL materials together with other classroom strategies would guarantee student success. More probable is that they provide opportunities closer to the "optimum" conditions that may help to compensate for lower aptitude.

## Attitude

Positive learner attitudes toward second-language learning have long been felt to contribute importantly to learner success. Therefore it is important to consider aptitude, attitude, and motivating factors as well: self-image, peer attitudes, and cultural attitudes toward the target language, the learning environment, and the teacher, whether the actual teacher or the

medium of instruction, including the computer. Clark (6, p. 456) reported instances of students attributing more fairness and impartiality to CAI than to their teachers, although some highly analytical students did not care for the limitations of restrictive responses in the CAI programs. In addition to aptitude and attitude, there are other individual variables to consider in structuring CALL programs, including how the learner perceives and what strategies the student employs in a learning task.

### Learner Characteristics

A recent example of research into learner perception—of interest both for software selection and for program design—is that conducted by Mellgren (24), who found that, in the programs she developed for students of Spanish, field-independent learners (those who demonstrate an ability to perceive meaningful parts of a whole and not be distracted by nonessential elements) were most responsive to CALL. Similarly, Krashen (18) has pointed to studies that indicate a relationship between field independence and the development of second-language proficiency in older children.

### Learner Strategies

An excellent source for investigating learner strategies is the research by McLaughlin (23), who claims that, in all likelihood, learners use two kinds of strategies when they learn a second language, both of which form hypotheses, as the grammar of the language is internalized. One set of strategies is found in virtually all learners and involves such things as simplifying, generalizing, imitating with simple and uncomplicated structures, and avoiding the unfamiliar or complicated. The second set tends to be idiosyncratic. The learner attempts to apply formal rules, uses rote memorization, guesses from context, looks for recurrent patterns, attempts to find opportunities to speak or hear the language, and goes to others for help. McLaughlin makes a case for using pedagogical rules in instruction by claiming that rule-guided practice may in fact facilitate storage in long-term memory, encourage retention over time, and aid automatic use of stored language patterns.

Seliger (31) also finds benefit in the use of pedagogical rules to encourage learners to manipulate and to understand the language by concentrating on specifics. Formal rules, according to Seliger, preclude the students' testing of false hypotheses and encourage creativity by aiding learners to construct their own grammars more efficiently.

McLaughlin and Seliger see formalized rules as tools to aid the student;

that is, as facilitators in the internalizing of input with a view to more efficiently informed and confident output. In short, it is important to consider learner aptitude, strategies, and learning styles for their relevance to software development.

### Proficiency Development

Higgs and Clifford (12) counsel that early correction of learner errors in the beginning stages of instruction is not only desirable but crucial to attaining high levels of proficiency. Their concern is based upon studies that led them to report that inattention to accuracy encourages and rewards communication at the expense of form and, in some instances, "fossilizes" the learner at a low level of proficiency. For this reason Higgs and Clifford recommend careful consideration of instructional goals, even to the point of multiple tracking. They advocate that feedback on accuracy of production be incorporated into teaching strategies. By extension, decisions about the creation and selection of software should be shaped by the nature of corrective and other feedback deemed appropriate to curricular goals. While achievement and proficiency are not identical, the academic curriculum has generally emphasized achievement. Often oral proficiency has been either an expected concurrent development or sacrificed to a degree. How to have both without ignoring either is a critical problem. The judicious use of CALL may be one of the keys that will unlock the door to future success in both areas. Formal instruction in the language may be largely via computers with class time given over to activities for interpersonal communication and the development of oral proficiency.

### Research Summary

The foregoing considerations of aptitude, attitude, learner characteristics, strategies, and proficiency have implications for both the learner and the curriculum. Let us now consider applications of this information in a training course that integrates technology and software in the learning process of teacher trainees. Because it is unlikely that computers will ever be expected to replace teachers under normal conditions, teacher education programs can help teachers to determine how best the computer may serve them and their students. The teacher education curriculum provides an opportunity to examine CALL software and investigate the purpose, the nature of feedback, the suitability for the level of instruction, and whether the design of the program is responsive to learner strategies. Training should include an investigation of the match between student needs and technological capabilities of the medium, while recognizing

that software at present does not match every deficiency or every individual learning style or strategy. There is, however, much promise. Interactive CALL with audio may make a significant impact on the student's phonetic coding ability, particularly with random access. Learners with little "grammatical sensitivity" can be led through stages to observe structures and language in action (see Garrett, Chapter 7 in this volume). In addition, the question of time on task can be investigated directly (Hawley and Rosenholz, 9), and more effective use of time has been one of the benefits noted from CALL used by foreign language learners (Curtin et al., 8). CALL can help learners see relationships between words and functions (for example, building word families, examining affixes and inflectional forms). Finally, teachers should be exposed to the potential usefulness of simulation and the promise of interactive videotape and videodisc for the nonverbal aspects of communication.

To date most attention to CALL has focused on its function as a support medium and its capacity to occupy part of the class in a meaningful task while the teacher concentrates on verbal activities with other learners. The profession has yet to see how effective CALL will be if and when more attention is given to developing programs for larger blocks of the curriculum.

## Training Needs

What needs are perceived by the profession for training preservice and inservice teachers in CALL? What has been done in professional programs and by others to respond to these needs? In 1983, Renney and Dupuis (30) cited studies in the 1970s in which recent graduates in education were asked to identify areas in which they felt inadequately prepared by their professional training experience. One was the use of media and instructional equipment in the classroom. Marty (20) in 1981 had already pointed to the crucial importance of involving foreign language teachers in the use and applications of computer technology. McCoy and Weible (22) have since warned of the possible disaster that could arise from a sudden urgent need to implement the use of CALL but with foreign language teachers unqualified to use it. Results of a national survey conducted by Stolurow and Cubillos (34) stress the need felt by foreign language teachers for training in CALL.

### Institutional Response

Imig (16), also writing in 1983, stated that, generally speaking, schools of education were training teachers in educational technology and that some

20 percent required courses in technology and computer literacy for graduation while another 35 percent provided elective courses in those areas. Has the picture changed? Wright (40) reports that in 1983–1984 nine out of ten college or university schools of education in the United States provided some access to computers, but this training was of a quite diverse nature: computer courses, applied computer courses, and noncredit inservice training. Each merits closer examination.

*Computer Courses.* Wright's survey defined computer courses as those devoting 80 percent or more class time to learning about computers themselves or to instructional applications of computers. Wright reports that roughly half of the schools responding to the inquiry offered computer courses to undergraduates in education while two thirds offered such courses to graduates.

*Applied Computer Courses.* The second category, "methods" curricula with a computer component, often involved more than one course defined by a criterion that 15 percent course time or less was devoted to computers. Wright found that over 40 percent of the schools with courses in computers also offered a course in instructional uses of the medium, but only one quarter offered instruction in programming; a mere 13 percent provided an overview of hardware or software or touched upon computer-managed instruction, defined as "computers as tools for teachers or students." Yet only one school of education in four required applied computer courses in teacher training programs for secondary education in fields other than computer science, science, or mathematics.

*Inservice Training.* The third type of instruction surveyed was noncredit inservice courses made available by schools of education through workshops, conferences, and seminars. Of the responding schools, almost half provided some training in this area, although instruction time varied from four to forty hours in length.

Curricula with a computer training component were considerably more prevalent than applied computer courses at the time of Wright's survey. Approximately half (52 percent) of the institutions offered courses in programming; 47 percent provided an introduction to computers; 31 percent gave courses for teachers and students in computers as tools; 28 percent provided an overview of software or hardware.

Wright's survey also asked respondents to rank-order various plans for initiating or for increasing a computer training program at their institutions within the next two years. Only 25 percent gave high priority to initiating or increasing inservice training programs while 46 percent gave that interest definitely low priority.

Finally, the institutions surveyed were asked questions regarding problems in initiating or expanding extant programs. Problem areas cited were: inadequate software (45 percent); inadequate hardware (34 percent); difficulties of integrating CAI into existing courses (26 percent);

lack of trained faculty (42 percent); and insufficient educational research (16 percent).

It is clear that institutions preparing teachers are making efforts to meet the challenge of technology, but the population targeted for instruction is narrowly defined for the most part, and the type of training uneven. It remains unclear whether training programs incorporating CALL will be mandated for all preservice teachers or whether offerings will be elective. Will programs include instruction in the use of hardware and software components? It is improbable that inservice workshops of only a few hours or days can prepare teachers adequately to select or to use software. Longer and more intensive training is required. An excellent model in this regard is the series of summer workshops and training sessions initiated by CALICO (Computer Assisted Language Learning and Instruction Consortium) held at Brigham Young University (1985) and Duke University (1986). Among others, topics treated have included materials development, lesson design, authoring, networking, graphics, voice, and interactive video. Such curricula, taught by specialists in CALL and foreign language, provide precisely the kind of training needed by teachers unable to obtain institutional training during the academic year.

**Noninstitutional Response**

There are, of course, inservice training possibilities other than those provided by institutions or professional societies. Stedman (32) called for the evaluation and prompt sharing of innovative teaching practices and recently developed, evaluated educational materials. Stedman places some of this responsibility in the hands of state agencies, claiming that institutions simply are not prepared to handle the volume of demand. His appeal is not alone. An investigation by Fisher (10) found that teachers are excited, not threatened, by new technology. They typically oversubscribe courses designed to introduce them to computer technology. He also noted that if educators and other interested parties fail to demonstrate the full potential that computer-related technology offers to education, companies that produce software will succeed in marketing substandard products because of insufficient critical evaluation to demand quality vis-à-vis pedagogical standards. Fisher also feared that a failure of sufficiently prepared and interested parties to capitalize on the benefits of technology would result in the postponement or even the loss of those benefits. He also considered that the "ordinary" way of training teachers in educational institutions was insufficient for the need at hand. In addition, Fisher emphasized the inability of local school districts to undertake research and development efforts by themselves. Pointing to the existence in some states of agencies such as the Minnesota Education Computer Consortium, he designated the need for federal support in research and

development. The uneven distribution of state resources required such consideration.

Many states are attempting to meet the demand through consortia of the type described in Minnesota. Regional offices of state agencies commonly offer noncredit workshops or training sessions in the evenings or on weekends. Rarely, however, are the trainers prepared to deal with specific disciplines, but rather are most qualified to explain computer programming in a general sense. As grateful as teachers may be for this otherwise unavailable training, unless discipline-specific considerations are given, the full potential of CAI instruction may not be realized. The same criticism may be leveled at workshops or training programs sponsored by corporations, specifically by producers of hardware, and related professional organizations. While informative, these sessions usually are directed by individuals more expert in programming than in pedagogy. The training is not necessarily fulfilling, especially if discipline-specific applications are missing. Moreover, such training is often expensive, and in districts with little money available for specialized training, foreign language teachers are frequently not considered priority faculty nor their curriculum most in need of such instruction.

## Teacher Concerns

In 1982, Brickel and Paul (2) reported the results of a survey in which, among other things, inservice teachers were asked to identify the three topics of greatest concern and those most needed as inservice topics for the future. Among the most common responses was the need for guidance in developing and teaching innovative curricula, including the use of self-instructional material. Some 40 percent of the respondents were teaching multilevel classes (more than one level in the same class hour or more than one language in the same class). For these teachers, help in developing multilevel instruction approaches was a clear priority. Brickel and Paul also found that 40 to 50 percent of the teachers surveyed attended annual state or regional conferences, and 65 percent attended local professional meetings. Only 20 percent attended national professional conferences, while another 20 percent attended national meetings every several years. Of the respondents, 70 percent reported reading professional journals and newsletters at least monthly.

Information about the quality of software and how to implement it into the curriculum is published in the professional literature and, through its pages, is most likely to reach inservice teachers. Nevertheless, reading about CALL is scarcely enough contact with its technology and application to give practitioners the confidence needed to make an impact on

their curriculum with the new media. A much better and thorough long-range tactic is to reach teachers in their preservice training as described below.

What approach is the most economical in time and content to ensure sufficient exposure and training? A preservice course suggests itself to provide an introduction to the psychology of language learning along with a technical understanding of program capabilities, software evaluation, and suggestions for implementation that are responsive both to learner need and to the demands of the learning environment. The authors have implemented such a course at a field site, permitting academic hands-on training and field experience with secondary school students using CALL. The scope and content of this preservice course is exemplified in the following section, and is offered not as a prescriptive blueprint for a teacher training course in CALL but as an example of a successful curricular approach to computers in language teaching that incorporates information and experience that contributes to the knowledgeable use of the medium.

## Technical Knowledge

What technical knowledge do foreign language teachers need to acquire in a CAI course in order to use CALL with confidence? Those who teach like to feel in control of the tools they use as well as the subject matter. Since many foreign language teachers have had almost nothing to do with computers, considerable anxiety may be generated by their lack of technical background. The topics that follow constitute a suggested outline for a course designed to prepare teachers to feel comfortable with the new medium.

### History

A good place to start a CAI course is with the history of the machine itself, which allows teachers to understand the natural progression from the 17th century calculator of Blaise Pascal through Leibniz's multiplier and the fundamental ideas of Charles Babbage to the earliest computers. The connection between Lord Byron's daughter, who programmed for one of the earliest counting machines, and ADA, the modern computing language named for her, provides a link from the humanities to the microcomputer that sets a positive tone for foreign language teachers in a new technical area. A summary of early history can be found in Clark and Lambrech (5). The computer is a new tool for arts and letters bringing aid and comfort to the humanist much as the arrival of the printing press enabled scholars to reach out to one another and to a larger public.

### CAI Terminology

Interaction with students is another area in which teachers are accustomed to feeling in control of the means of communication, both in the foreign language and in English. New vocabulary must be acquired and used in order to converse knowledgeably with students who are interested in programming on the computer. If new CAI terms are presented to teachers as steppingstones to assist them in understanding the computer, this will facilitate learning to use it. The principal terms can be demonstrated or used in meaningful contexts as the teachers work with programs. Recent glossaries of computer technology terms are helpful, such as those compiled by Hope et al. (15), Jones (17), and by Pusack in Chapter 1 of this volume.

### Programming Languages

The more popular programming languages, for example, LOGO, BASIC, FORTRAN, TUTOR, Pascal, and PILOT, can be differentiated by identifying and describing them. Teachers who later decide to create lessons will have a basis for deciding which programming language to use. Moreover, knowing what some of these languages can do can assist in judging software. One difficulty with some CAI material is that the computer language in which it is written is not flexible enough to accommodate a variety of possible student responses. On the other hand, a lesson loaded with intricate branching, elaborate help sequences, gratuitous comments, and graphics unrelated to the lesson content might be the result of an irresistible urge on the part of the programmer to show off the power of the programming language and, in the long run, may or may not make a contribution to learning. In addition, a discussion of what is meant by machine and assembly languages or compiled and interpreted BASIC will go a long way towards familiarizing teachers with what their own students are talking about and what popular computer magazine articles on the subject are referring to.

### Hardware

An overview of the techniques used for running programs on the microcomputers in common use in the schools today will encourage teachers to try new machines and programs. The Tandy, Commodore, APPLE, and IBM families of microcomputers are used in many high schools and universities. Each has unique routines to turn the equipment on and off and to load and run programs. Each has its own maintenance and checking systems. Even a quick look at a program for word processing will reassure

and enlighten those teachers who have not yet used the microcomputer in this way. Hands-on experience with as many of the machines and programs as possible is essential to instill confidence.

### Databases

The use of organized collections of data called computer databases is growing in schools. Preservice teachers can profitably explore a simple database system because all teachers must become familiar with the system in their school. And in social studies and English, for example, where literature searches are common (and in foreign language, to a growing extent, when the students research topics relating to the culture of the language studied) teachers must know how to assist students to set up their own databases. Since prospective teachers do not know what facilities and help will be available to them later in their schools, they will find practice with an uncomplicated database particularly valuable.

### Hard Disk and Networking

Similarly, an acquaintance with hard-disk management can permit teachers to interact comfortably with networking systems, which are used increasingly in the larger schools. The problems of setting up indices (to find material of specific interest), of backing up the system to ensure against inadvertent loss of programs, of loading material into the computer system for the whole school, not just foreign language programs, are best tackled before teachers are faced with the care and maintenance of such powerful hardware in their parent institution. Effective use depends upon a basic understanding of the advantages and potential trouble spots of a hard disk with or without networking.

### Programming

An important part of teacher training on the technical side is acquiring a feeling for what programming is all about. In a series of reader surveys in *Classroom Computer Learning* (29), teachers have asked for a more detailed look at how CAI materials are constructed. Experience indicates that among the programming languages available now, PILOT is a good place to start. A good working description of the language can be found in a recent publication by Conlon (7). (The versions of PILOT used at the University of Illinois in the training program described below are: SuperPILOT, Cupertino, California: The Apple Company; and PC

PILOT, Boca Raton, Florida: International Business Machines, from PC PILOT, Bellingham, Washington: Washington Computer Services, 1985.)

PILOT furnishes a nice blend of simplicity of form, usability, flexibility, and relatively low cost. Simplicity of form means that it is easier to comprehend and faster to learn than some other languages for teachers who do not expect to become professional programmers. Usability refers to its general ability to allow the creation of a great variety of teaching programs, drills, tutorials, simulations, problem-solving lessons, and games. And, for foreign languages in particular, character sets are readily drawn, made accessible through the keyboard, and made available to the user of the computer lessons according to the requirements of the lesson content as planned by the teacher/programmer. Graphics (illustrations, backgrounds, animations, simulations) can be created and connected easily to the lessons. One version of PILOT for the IBM, PC PILOT, will permit the use of a variety of graphics packages beyond the one provided in the package. SuperPILOT for the Apple provides a superb graphics package that can be used immediately by teachers new to programming. PILOT's flexibility is evidenced by the choices available to the programmer for answer judging. The MATCH command allows the teacher/programmer to accept a wide variety of responses on the part of the learner, yet restrictions on responses are possible when necessary. Alternatively, when exact matches are required, which is often the case with CALL materials, PILOT can be written using numerical and string variables. A recent workshop conducted by University High School, University of Illinois, revealed that foreign language teachers who were absolute novices in CAI could learn to create a PILOT lesson, free it from programming and factual errors, test it with a few users, and demonstrate it within two weeks. The most primitive lesson contained a few similar drills with randomization, a character set differing from English, illustrations, and explanations. All but a few of the teacher/programmers accomplished even more, creating a variety of lesson segments, some with unique and innovative routines for interaction with student users.

Undergraduate teacher-trainees in a recent one-semester CAI course also at University High School each prepared one drill using SuperPILOT on the APPLE microcomputer. In this exercise, the trainee created at least one graphic, employed a foreign character set, and developed a series of questions in the second language of their training. No two drills were alike. Some drew attractive scenes and related the questions to the visual material. Others used cultural differences as their theme. One revealed a wry sense of humor that came through successfully in the computer material. In the words of one trainee, this part of the course was "mindblowing."

In addition to working with one system, teachers also need to know that additional excellent programming assistance is available. For example, at the University of Iowa, Pusack (28) has created DASHER, software that allows authors to insert their own material. The software automatically

sets in motion a judger that marks errors in the answer, instantly alerting the student to their position and nature, a strategy designed to capitalize on the advantage of immediate feedback (error detection) and nonjudgmental correction (anxiety reduction). The teacher/programmer can build with DASHER a wide variety of exercises including transformation, substitution, fill-in-the-blank, true–false, multiple choice, vocabulary building, translation, and other drills.

For teachers who wish to program in BASIC on a more long-term basis, an authoring aid titled EnBASIC by Tenczar, Smith, and Avner (36) allows extremely flexible sentence judging combined with a precise answer markup system and easy handling of character sets. At present, graphics for programs in EnBASIC must be accomplished either by placing drawings on character sets (attaching sections of a picture to letters of the alphabet) or through independent graphics packages (for example, the *Graphics Magician* brought out by Penguin Software) with the associated increased need for programming knowledge. A very advanced authoring language for the microcomputer is "TenCORE" by Tenczar et al. (35), which is set up for both IBM and APPLE microcomputers.

There are also a number of authoring languages that allow teacher/programmers to insert their own problems into a prearranged computer program in addition to the authoring languages already mentioned. However, after the initial novelty of preparing lessons on the computer wears off, some authoring systems may turn out to be somewhat confining. Teacher/programmers may be limited to using a few exercise formats rather than creating new ones. On the other hand, for a teacher who would like to add CAI-mediated exercises to the curriculum quickly, it is helpful to know that these systems exist. More elaborate systems are being developed that may become more flexible and attractive to use as time goes on. For a discussion of this topic consult Holmes (13).

That all teachers will want to do their own programming is highly unlikely. On the other hand, the belief that it is not worthwhile to provide any training in programming, since overburdened teachers do not have time to write software is an oversimplification. The best teachers already spend a great deal of time preparing innovative class activities. Those who are attracted to using and later preparing CAI for themselves should have access to the necessary training. (See Otto and Pusak, 26.) Teachers who may direct students in writing CAI/CALL lessons for the class need to know what can reasonably be accomplished by computer and what is too time consuming or can be done just as well by another method. At the very least, the teacher's intellectual curiosity is satisfied and a better basis for judging commercial software is established.

## Current CAI/CALL Materials

What kinds of CALL exist today that must be taken into consideration by

foreign language teachers and by those who train teachers in this field? CAI and CALL may be divided into five basic types for purposes of clarification (although effective CAI materials generally exist in combination): tutorial, drill, simulations, problem solving, and games.

### Tutorial

Tutorial programs include initial topic presentation and review. They may present facts, raw data, or problems, then clarify, outline, explain, and discuss them. They may detail an outline for skill development from step 1 through to step *n*. They may present, analyze, or synthesize ideas, concepts, or theories, making deductions and drawing conclusions from them.

### Drill

Drill programs offer extensive practice, either on a single concept or a series of problems that require massed practice. Drill-based materials assist students in retrieving the practiced items more rapidly at a point when they are needed later for conversation or writing. Drills are developed as practice aids to help students express themselves more freely and confidently, especially in a highly inflected second language. Supplementary interactive CALL drills take place at a lower stress level than in typical teacher/student classroom exchanges. Guided instruction keeps more distractible students on task and is therefore more efficient for them. Remedial drills and "make-up for missed work" are primary areas where CALL practice can help the student catch up with the class.

### Simulations

Simulations via CAI/CALL are limited only by the scope and imagination of teachers and students. Students can interact with computer programs on a background of illustrations or with the simulation itself or they can build screen displays to show their growing control of the second language. For example, students could be asked to route oil tankers from production points to final destination keeping in mind the political and physical forces that would interfere with such a route, answering questions in the target language as they develop proposed trade routes. Culture such as history (perhaps a series of maps portraying changes of borders/rulers with interactive practice and optional discussion) or art and architecture typical of one group of people (illustrated, discussed, connected to the people's history, politics, and economic changes) are samples of what can

be taught effectively through simulation. Language can be taught or reinforced along with cultural knowledge, with varying emphases depending on the student's level of proficiency and control of the second language. Situations in the foreign culture (e.g., the restaurant or the market) can be portrayed even through illustrations as simple as stick figures made to converse in idiomatic language to which the students are expected to respond. Everyday customs, habits, or details of lifestyles can be brought to life through simulations that include animation as well as static drawings and background illustrations. Language suitable to business, science, and agriculture can be taught, used, and practiced in those contexts with graphic illustrations.

### Problem Solving

Problem solving applies as much to foreign language as to mathematics. In a Russian grammar example, first a form can be learned such as the perfective aspect of a verb, then a contrasting form such as the imperfective aspect, followed by the use of an auxiliary to express the imperfective future. These forms can then be asked for, presented as contrasting verbal forms in contextualized sentences and followed by verbs in a variety of contexts. In well-constructed CALL software, students are asked to use these forms as they learn them in order to respond to a series of simulated real-life situations. In another example, contrasting grammar usage between the second language and English can be pinpointed on the screen through interactive CALL programs. The student can be led stepwise in a series of contrasts between troublesome differences in grammar. In a Russian example again, the difference between "I have a book" in English and "A book is of/by me" in Russian might require a series of student responses indicating that the difference has been understood. The small screen, the focus, and the call for response all concentrate the student's attention on the problem at hand.

Problem solving can also include a wide variety of situations in which the student takes newly acquired knowledge in several areas and synthesizes the correct responses in novel situations. If the emphasis is on cultural differences rather than language, problem solving can also require adaptive responses to certain behaviors expressed either in the second language or in English. As an example, the student is asked about a figure gesturing on the screen. Does the gesture indicate "goodbye," "hello," or "watch for thieves"?

### Games

Games can run the gamut between those that concentrate on the

recreational aspects of the activity and those that are similar to simulations or drills with scoring added. The ideal game is one that exercises a wide range of the student's vocabulary and language usage while incorporating challenge (variable difficulty levels), chance, dexterity, mystery (fantasy, curiosity), and speed (Malone, 19). In better games, the activity that makes for success should be an integral part of a learning process. For example, if students had to learn certain key words, "key" and "lock" in French, and then had to use them correctly to advance through a simulated house (in order to find a treasure—an adventure game) then the use of these words would be natural (the students unlock a door). The students would improve their French and "win" in a direct and positive correlation. Unfortunately, in most games of this nature, the time spent in "unlocking the door" makes learning the words "unlock" and "key" very inefficient. Idiomatic and correct use of the verb as well as recalling the noun is not required in current games of this kind, possibly because it slows the game too much. Games, then, are compromises between how much time and effort is given to active time on task in the foreign language and how much is spent on the mechanics of the game. More recreational games can be used as rewards for completing other activities, and games predicated on a great deal of studied learning can be fitted into the curriculum on a more regular basis.

## Combinations

After discussion and demonstration of various types of software, it should be apparent to the teacher learning about CALL that combinations of types will enhance the educational process. Tutorials are much more effective when accompanied by practice on each point interspersed with explanation. Or tutorials can be worked into student interaction with simulations. A series of drills on various points of grammar or culture can be integrated to develop a problem-solving exercise. Students can learn to solve various language problems by working through simulated foreign situations. For example, a shopper appears on the screen in an open-air market and asks the price of certain foods in the target language. A choice of possible replies by the merchant is presented under the picture. The student picks a reply and sees its consequences on the screen. Games can consist of gamelike drills or simulated interactions with foreign language speakers. They can also consist of general problems to be solved using reasoning, skill, dexterity, and intuition in a game format.

## Instructional Concerns

Another major area that must receive careful consideration by teachers who are involved in CALL use or development falls within the sphere of pedagogy. How does computer-assisted instruction relate to the problems of teaching in general? What general instructional concepts must the foreign language teacher consider when planning to judge or write CALL? Because the medium is so new, insufficient thought has sometimes been directed to pedagogical considerations when judging or developing CAI. A pioneering discussion can be found in Steinberg (33) who summarizes the roles the teacher/author/programmer must assume when creating software. These same factors must be discussed in some form in any course offered in teacher training for CAI. They include expertise in content, learning theory, lesson design, computer programming, and evaluation. If these roles are treated as general educational concerns for any teacher involved in CAI, associated instructional questions will lead to the logical development of criteria for judging software.

### Content

A primary concern for foreign languages is accuracy of content. Preteachers especially need to learn to be critical of published CALL materials. Semantic, lexical, and syntactic accuracy in the foreign language must be considered along with cultural authenticity. A native speaker should be consulted when a dubious point arises. The software should demonstrate grammatical accuracy, modern expressions, and up-to-date style. Authentic cultural surroundings are a must. John and Wendy pictured sitting in an American-style fast-food establishment speaking Spanish does little to broaden the students' cultural awareness of the rest of the world, no matter how far the hamburgers are supposed to have traveled.

### Learning Theory

A second major area of instructional concern in training teachers for CALL lies in learning theory, especially with regard to motivation. Highly motivated students of foreign language want to achieve proficiency. Well-constructed CALL materials can motivate students toward that goal. To allow students to use software that is repetitive, error-filled, slow-moving, unillustrated, and poorly planned, and which provides little chance for student input is a serious misuse of CALL and dampens motivation. On the other hand, a positive learning experience makes it clear to students that their skills are increasing and that their proficiency can improve.

Rewards that lead to higher motivation should be provided to help the learner achieve a feeling of progress and personal enjoyment in working through a variety of computer programs.

The endless patience of the computer and the privacy of the CAI learning situation are two factors thought to reduce anxiety in learners. Preservice teachers should be warned to avoid programs that use critical remarks about students in feedback even in jest. Audio cues of an unpleasant nature should be used infrequently and with caution. Force-timed routines should be avoided along with forced repetition of exercises. (See Holmes and Kidd [14] for a discussion of learner control.) Students using CALL should always have a sense of where they are in each exercise and in the overall lesson scheme. They should never be left without recourse to help when unable to answer a question. Except in the most obvious situation, i.e., a choice between *a* and *b*, the correct answer must ultimately be available to them no matter what format is chosen for display.

Teachers new to CAI should learn to look for programs that offer students variety. This increases motivation for learning, because the students get a feeling of being in control. Higgins and Johns (11) recommend leaving choices (which drill, what repetition, what path and rate of learning) to the student whenever possible, whether the materials reflect an extensive serious approach or recreational learning. A discussion of the effect of individual differences on instructional variables and the necessity for the development of more student control as the student moves through a CAI lesson can be found in a recent article by Tennyson and Park (37), who counsel that fast-moving students should be able to move ahead, take on extra activities, or repeat selected areas of their own choosing at will. Slower students similarly need to proceed at their own pace and to review at leisure. Students should be challenged but feel in control, inspired but not anxious, stimulated but not tense, active but not driven, helped but not harassed by CAI.

Teachers need to take a good look at the population each software program is intended to reach. A CALL program must be directed to the level of the users. Relevant questions to consider are: What is the students' preparation? What is their reading level in English? What level of language sophistication have they reached? What general age is targeted? Instruction should proceed from the simple to the more complex, but it should begin at the students' current level, and the student should be prepared for the next step. Obviously grade school pupils have interests different from those of college students. Even the directions to the user must differ in addressing these two groups and those in-between. There should be serious programs and those in a lighter vein. However, fun for children might bore the young adult and subtlety may be lost on the very young.

Learners vary in their physical receptiveness to the study of foreign languages, that is, whether they are eye- or ear-minded. A few students feel

much more at home with the spoken language. They enjoy, understand more directly, and prefer instruction through listening; they do not feel too uncomfortable even when making mistakes in speaking. Other students feel strongly that they must see the written word before they can retain it, and are particularly sensitive to mistakes in their speech. A few would prefer to substitute learning about the culture for learning the language itself. Most students have a mixture of such feelings. Teachers attempt to satisfy the needs of all by providing a mix of instruction in the four skills with large doses of higher culture and everyday life abroad. Owing to the extra, private time afforded to listening and comprehending the second language, the language laboratory appeals variously to students who enjoy learning by ear and to those who have trouble listening and understanding. CALL programs as offered today attract the students who want at least part of their instruction to be eye-based. In addition, the most recent, heavily illustrated CALL lessons appeal to those for whom a picture is worth a thousand words.

## Design, Execution, and Evaluation

In the following discussion of computer lesson design, programming techniques, and student evaluation, a series of open questions will be proposed for consideration by teachers using or developing CALL. Rather than prescriptive answers to these problems, the value of posing such questions in a CAI course lies in the fact that they stimulate teachers toward thinking about these problems. The answers depend on the conditions under which the teachers work with computers, on the student body they teach, on the goals they and their students have set, and on the demands of administrators and parents. As teachers answer the questions individually, they will be guided to develop criteria that are generally applicable to CALL. Suggested criteria to this end are appended to this chapter. (See also a discussion on this topic by Wyatt and Hubbard, chapters 4 and 9, respectively, in this volume.)

*Lesson Design.* A practical concern that must be discussed with teachers learning about CALL is lesson design. What sequencing and/or branching should be used? Is there forced branching that depends on a scoring algorithm or is the decision left to the student? How long are the lesson subsections? What are the options for repetition and review? What testing is done and when? Which are optional exercises and which are required? Are the lessons discovery-based (inductive) or do they depend upon reasoning from general principles (deductive)?

Screen design poses other problems. How much should be presented on one screen? The amount may depend upon the context and what is to be taught. What graphics are necessary for clarity? What illustrations improve the lesson? What pictures attract the student? What decoration

has been added? Are color and sound used, and how? Is sound optional? Are timed activities included and are they optional? Answers to these questions should indicate that the CALL author has taken into account what is being taught in relationship to what audience or user the effects are intended to reach.

Decisions about lesson design also depend partially on content and learning theory. What to present and how to motivate the learner heavily influence the arrangement of the lesson. As an example, many changes of pace and activity, bright colors, explanations worded in language suited to the less-mature, less-sophisticated, less-prepared student are expected in materials intended for young children.

*Technique.* Technical programming problems are particularly worrisome for novice teacher/programmers, since they present entirely new questions rather than familiar ones in a new context. What kind of answer-judging techniques are used for lessons in CALL? Are they open-ended? For instance, can students enter a somewhat personalized rendition of the answer to a question as long as they include at least the sought-after key portion of a correct answer in the response? Are only grammatically correct responses accepted? Whether open-ended or exact, are synonyms admissible and provided for? How do the answer-judging routines handle spelling mistakes? Is there a possibility of changing the spelling conventions according to the instructional situation? For example, the spelling requirements for English might be less stringent when that is not the focus of the lesson. Are foreign character sets clear and easy to read? Can English and the foreign language be mixed at will? Are uppercase and lowercase used and easy for students to access? Are the graphics drawn compatible with the screens available in most schools? How are data managed if the CALL in question gives the option of storing/collecting data? What data are valuable? How easily can the teacher collect data? In what form are the data presented? (As totals? In graphs?) What clearing of student data on the disks is the teacher required to do in order for the students to add new data?

*Evaluation.* How does the software being considered evaluate student performance? Is there forced branching to review material if the scores are sufficiently low, or are there suggestions for review provided for the student? Each teacher must consider carefully whether to use software for student self-testing or for gathering test scores. If evaluation of student performance is done, how does the teacher collect the data? Are tests taken without teacher supervision to carry the same weight as supervised evaluation?

*Criteria for Software Evaluation.* Once teachers studying CALL have been alerted that content, learning theory, lesson design, computer programming, and evaluative techniques are critical in judging computer software, they can form evaluative criteria to review sample software. An

adaptation of the general criteria for evaluation of CAI suggested by Peters and Eddins (27) can be found in the Appendix. Examples follow:

A. Language-based criteria
   1. Is the lesson content correct?
   2. Is the language used authentic culturally?
   3. Is colloquial language used?
B. User-based criteria
   1. Is a specific audience of student users addressed?
   2. Are the computer responses to student input nonjudgmental and encouraging?
   3. Is the program flexible enough to provide for individual differences in student responses?
C. Instruction-based criteria
   1. Are the lesson segments integrated and sequenced logically with flexible branching?
   2. Is the material arranged interactively, requiring thoughtful replies from the students?
   3. Are the responses from the computer program meaningful and helpful?

These are only a few of the criteria in each category, many of which the teachers discover for themselves. With the aid of these criteria, teachers can be led to make evaluative decisions about software on the market now.

### Critiques

How can teachers be taught to judge software? One of the best ways to teach evaluation is to ask foreign language teachers to try out as much software as possible interspersed with lectures about CALL covering the topics discussed earlier in this chapter. Following an initial evaluation of sample CALL courseware (which deliberately covers poor as well as good examples) teachers investigate student reaction to samples of programs. Listening to what students say as they work with CALL materials can lead to a genuine understanding of the process the students are going through as well as provide an in-depth and critical look at the software. What seems attractive and clear to teachers may baffle students. Some programs that appear unsophisticated to teachers can be popular with students if they have a gamelike appearance.

In the light of student reaction, issues in learning theory present themselves with renewed force. Is the student–machine interaction a barrier to learning or is it more or less transparent? Do the students feel comfortable with the mechanics of the program so that they can concentrate on learning or are they distracted by confusing directions or unexpected

branching? Is there help when the student really needs it, or is the help unnecessary and unused while genuine problems are neglected? Only a student sampling CALL software can tell the teacher how it feels to learn in this way.

### Training in the School

As well as evaluating CALL in the light of student reaction, the teachers in a training program typically plan and lead CALL sessions integrated with the curriculum. A variety of activities build competence in this area. Teachers (1) write goals and objectives for various software programs, (2) block out a plan for using CALL in the classroom, in the laboratory, and as homework, (3) demonstrate the capability to lead a class through a CALL lesson, (4) work with small groups while supervising others working at the computer, (5) give demonstrations using a large screen either in the classroom or the microcomputer center followed by practice monitoring the entire class, listening and giving help when needed, and (6) supervise individual students who are reviewing or taking tests at a student microcomputer station or playing language games as reward for good work.

### Culture and Daily Life

The potential of CALL to deepen student understanding and involvement with foreign culture and to enrich and enliven foreign language instruction is so great that training programs should give much attention to this aspect. On the small screen, students can see changes in geography connected with political and economic events in the history of a particular group of people. They can interact in the second language with simulations that will bring culture to life, e.g., connecting the art of a particular culture with its language in a lively and attractive way invites the student to learn in a fashion that cannot fail to arouse interest. The simulation may be a pale copy of real life, but considering the little time most students can spend abroad, these simulated activities provide some part of an in-country, cross-cultural experience and help prepare them for the real thing. Geography, history, politics, economics, art, and architecture lend themselves especially to CALL presentations and need not be target-culture specific as long as the programs reflect the target language in question.

The customs and culture of daily life in foreign countries are equally good candidates for CALL lessons. Through drawings, tracings, or maps for example, the students can view ordinary life abroad, the bus trip, the hotel, or the circus to name a few possibilities. They can translate what

appears on the screen, perhaps a conversation or narration, or choose the correct response (in the second language) or from a variety of correct responses that lead to differing story lines. Games involving choices between culturally authentic responses and those that are correct in our culture but not in another can mix fun with learning.

Specialized language in daily use about weather or occupations can be introduced with drawings or in games on the small screen. The vocabulary of the professions can be illustrated similarly as it is introduced and used in simulated contexts. All this is looking ahead, but the teachers in training now may provide models of these types of programs as future authors of software.

## The Future

No course for pre- and inservice teachers would be complete without a look ahead. Changes occur so rapidly in the computer field that the future may be upon us and our students before we finish exploring the implications of today. Illuminating remarks are to be found in papers by Meredith (25) and Wyatt (41).

A positive development that opens new dimensions for CALL is videotape and videodisc material interfaced with CAI programs. These media provide a moving picture with sound in a combination attractive to students. One drawback is that the amount of material to be worked with is fixed; changes cannot be made in the original type or disk. This problem will be overcome partially when costs go down and much more material is available. Unfortunately, creating the accompanying CALL software takes a great deal of time and therefore effective instruction will come slowly. Videotape is less costly, but the result is limited to back-and-forth access, while videodisc provides random-access but is more costly. See a discussion of this topic in McCoy and Weible (22).

The integration of sound with CALL presents a problem with several possible solutions, each of which has severe drawbacks. Simulated speech is currently not good enough to be used for second-language teaching. Voice digitalization takes too much memory to be practical. The use of a tape recorder under computer control has synchronization problems and loss of random-access capability; interactive videodisc technology overcomes some of these drawbacks but is still in its infancy. Consult a summary of these problems by Ariew (1).

In a discussion of the future of CALL the field of artificial intelligence (AI) cannot be neglected. Until now, theories of AI have not had much impact on CALL. Ideas about teaching the computer enough rules and facts so that it can respond to students in a manner similar to a human have been only moderately successful. However, teaching the computer to

"think" reveals some of the processes people go through and should eventually be valuable to teachers. Teachers and teacher candidates should be introduced to CALL/AI (See Chapter 8 by Underwood in this volume) and encouraged to continue following this research in their reading. More important even than what the computer might do by itself is what teachers can do with such a useful ally. The computer can extend the capabilities of a search for knowledge in numerous ways by handling raw data, carrying out directed syntheses, or providing graphic representations of theories or assemblages of facts. A useful discussion of this topic can be found in Higgins and Johns (11).

## Conclusion

This chapter has revealed that educators in general and the foreign language profession in particular sense the necessity for teacher training in CALL. The most economical and practical method of training is through preservice programs, since it is not easy to reach teachers in the field. However, training institutions need to expand outreach and inservice programs as well. Professional foreign language organizations must also continue to serve the practicing teacher with preconference workshops and conference sessions in order to share and disseminate innovations and applications in CALL.

Criticism of current CALL must not dissuade teachers from its use. In the future, CALL can be used to explore modalities other than those useful in providing formal understanding of a second language. However, the profession cannot postpone using CALL just because the medium and its materials do not do the ultimate now. Teachers must be trained to evaluate software available today in terms of its technical capabilities and merits, its content, and curricular goals. Cognitive development, aptitude, and learner attitude, attributes, and strategies all help determine the appropriateness of software for thoughtfully planned integration into the curriculum. Second-language educators must be prepared to move with the times, trying new CALL techniques as they become available. They also must be encouraged to ask for new tools as they learn about them in the literature.

Curricular suggestions for training teachers outlined in this chapter are summarized in the following outline of a syllabus for an introduction to CALL:

**Technical knowledge**

- History
- CAI terminology
- Programming languages
- Hardware
- Databases
- Hard disk and networking
- Programming with hands-on experience

**Instructional concerns**

- Content
- Learning theory
- Design execution and evaluation
  - Lesson design
  - Technique
  - Student evaluation
  - Criteria for software evaluation

**CAI/CALL**

- Tutorial
- Drill
- Simulations
- Problem solving
- Games
- Combinations

**Student critiques of software**

- Training in the school
- Emphasis on culture and daily life for CALL software
- The future

In summary, curricular suggestions for a CALL course for teachers include familiarity with the history of microcomputers, with technology, and with educational concerns touching the use of CALL. Consideration is given to learner needs and professional objectives in the use of this new medium. A rationale is provided for the selection of CALL for school use through suggested criteria. Practical experience with students in school using CALL reassures and encourages beginning teachers to use this tool. Hands-on experience preparing CALL programs deepens insight into both the constraints and possibilities of the medium. A brief look at future developments sets the stage for teacher self-education. The chance to enhance one's teaching using a new, powerful assistant has arrived for those who are willing to take on the challenge. The inservice course for teacher training described here will make it easier for teachers to approach this new medium, the microcomputer, and to participate in the opportunities of the Communication Age opening before us all.

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